MILESTONE
HELPING CHEMISTS



HIGH-QUALITY EXTRACTS
FROM NATURAL PRODUCTS



ETHOS™ X and ETHOS™ X LEAN

Microwave Platforms for
Green Extraction of Natural Products











ADVANCING NATURAL PRODUCTS EXTRACTION

UP-TO-DATE EXTRACTION

The extraction of essential oils and natural compounds from plant materials is a key step in the study and development of fragrances, flavors, and high-value natural ingredients. While analytical techniques have evolved significantly, extraction processes are still often based on traditional approaches such as hydro-distillation or Clevenger systems.
These conventional methods typically involve:

» Long extraction times, often requiring several hours
» High consumption of water and energy
» Thermal degradation of sensitive compounds
» Alteration of the original profile of essential oils
» Limited flexibility when working with different plant materials

To address these limitations, Milestone has developed the ETHOS X and ETHOS X LEAN microwave platforms, enabling a new approach to natural products extraction. By using a solvent-free microwave process, these systems deliver high-quality extracts in a significantly shorter time while preserving the integrity of the original compounds and supporting a more flexible approach to method development.



HIGH-QUALITY EXTRACTS • Preserves the natural profile of compounds

SOLVENT-FREE PROCESS • No solvents and reduced environmental impact

FAST EXTRACTION • Rapid process with reduced energy consumption

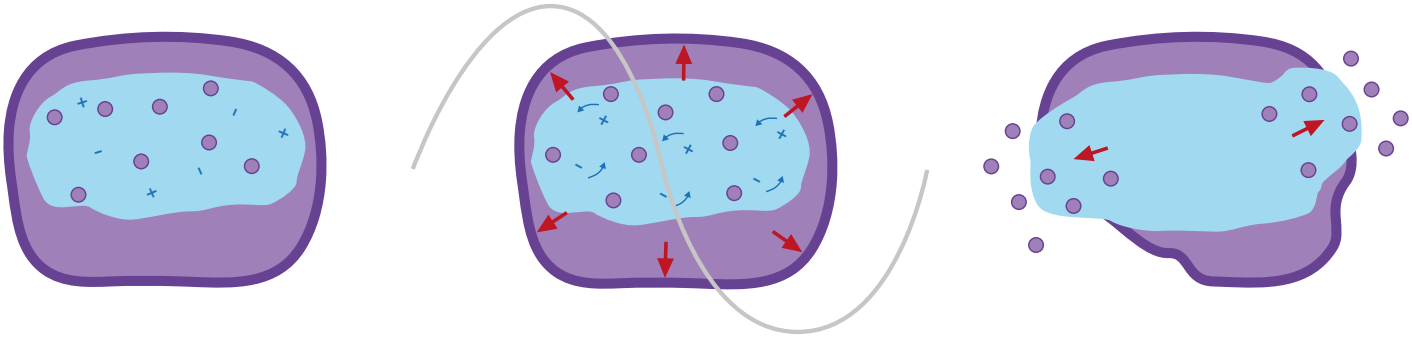
NO THERMAL DEGRADATION • Avoids by-product formation across samples

SCALABLE PLATFORM • From small-scale to larger batches

SOLVENT-FREE MICROWAVE EXTRACTION

SELECTIVE MICROWAVE HEATING

The ETHOS X and ETHOS X LEAN platforms use a unique solvent-free microwave extraction technology developed and patented by Milestone. This approach enables the recovery of essential oils and natural compounds without the addition of solvents or water, preserving the integrity of the sample while significantly reducing extraction time. Microwave energy is selectively absorbed by the natural water present within the plant material. As the internal water heats up, it expands and ruptures the plant cells, releasing essential oils and other target compounds. The in-situ water is then evaporated and condensed, allowing the extract to be collected efficiently without external solvents. This patented process enhances extraction efficiency, avoids thermal degradation, and preserves the original profile of the compounds.



The microwave selective heating process

The solvent-free microwave extraction technology at the core of the ETHOS X and ETHOS X LEAN platforms was developed in partnership between Milestone and the Laboratory of Chemistry, Natural Substances and Food Science at the Université de La Réunion, France. This collaboration resulted in two proprietary techniques — Solvent-Free Microwave Extraction (SFME) and Microwave Hydro-Diffusion and Gravity (MHG) — and led to multiple European patents, including EP 1 439 218, EP 1 618 798, EP 1 629 725, and EP 1 955 749.


EP 1 439 218 A1

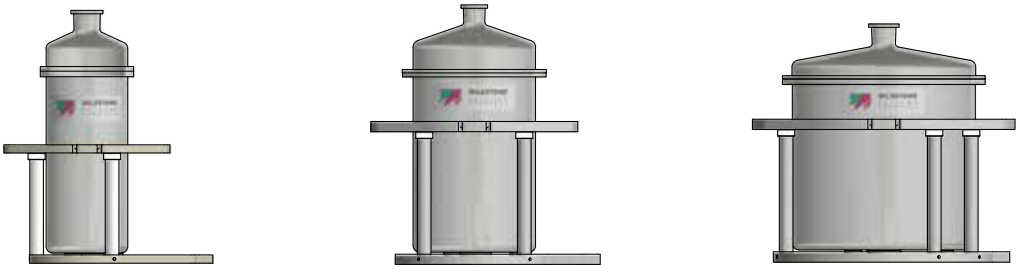
EUROPÄISCHE PATENTANMELDUNG

Patent EP 1 439 218

FLEXIBLE PLATFORM FOR NATURAL PRODUCTS EXTRACTION

SCALABLE REACTOR CONFIGURATIONS

The ETHOS X and ETHOS X LEAN platforms offer flexible reactor configurations to adapt to different sample volumes and application needs. From small-scale experiments to larger batch processing, the system can be configured with reactors of different capacities. ETHOS X supports reactor volumes of 2, 5 and 12 liters, while ETHOS X LEAN offers configuration up to 2 liters, enabling laboratories to select the most suitable setup based on their throughput and application requirements.



2, 5 and 12-liter glass reactors for fragrances

RELIABLE PROCESS CONTROL

Accurate temperature control is essential to ensure reproducible extraction results. The ETHOS X and ETHOS X LEAN platforms use an advanced infrared sensor that directly monitors the real temperature of the sample during the process. This enables uniform heating, controlled operating conditions, and consistent extraction performance across different plant materials and sample sizes, ensuring reliable results across a wide range of applications.



INTUITIVE OPERATION

The ETHOS X platforms are designed for simple and efficient operation. Pre-defined methods and an intuitive interface allow users to quickly set up and run extractions, while maintaining full control over process parameters when needed. Milestone Connect provides access to methods, applications, and technical resources, supporting users in optimizing their extraction processes and adapting them to specific research needs.



HIGH-QUALITY ESSENTIAL OILS IN MINUTES

The ETHOS X and ETHOS X LEAN platforms enable the extraction of essential oils directly from plant materials through a simple and efficient process. The sample is placed into the reactor without the addition of solvents or water, and the extraction is started using pre-defined methods. Within minutes, essential oils are released and collected through a controlled condensation process. The extract can be analyzed directly without any clean-up or solvent exchange steps, significantly simplifying sample preparation.
The short extraction time minimizes thermal exposure, preserving the natural profile of the compounds and ensuring high-quality results.

FRAGRANCES
EXTRACTION FROM NATURAL PRODUCTS



Extraction of essential oils from aromatic herbs

	ETHOS X		Hydro-distillation	
	Time *(min)*	Yield *(%)*	Time *(min)*	Yield *(%)*
Basil *(Ocimum Basilicum L.)*	30	0,029	270	0,028
Garden Mint *(Mentha Crispa L.)*	30	0,095	250	0,095
Thyme *(Thymus Vulgaris L.)*	30	0,160	250	0,161

Solvent-free microwave extraction of essential oils from aromatic herbs: comparison with conventional hydro-distillation. Journal of Chromatography A, 1043 (2004) 323-327



Extraction of essential oils from orange peel

	ETHOS X	Hydro Distillation	Cold Pressing
Extraction time (min)	10	180	60
Yield (%)	0,4	0,4	0,15
Total oxygenated compounds (%)	1,6	0,9	1,1
Total non-oxygenated compounds (%)	97,4	98,5	98,2

Solvent-free microwave extraction of essential oils. Chemistry Today, Vol. 26 n. 2 / March-April 2008



FLAVOR EXTRACTION

In addition to essential oils, the ETHOS X and ETHOS X LEAN platforms support the extraction of flavors and a wide range of natural compounds from plant materials, extending their application across different research and development activities.

Using Microwave Hydro-Diffusion and Gravity (MHG), the system enables the extraction of volatile and non-volatile compounds such as flavors, pigments, flavonoids, and carotenoids. The process allows compounds to diffuse out of the plant material and be collected without the use of solvents. Compared to traditional extraction techniques, this approach significantly reduces extraction time while maintaining the quality and integrity of the extracted compounds.



Complete view of the flavors configuration

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Established in 1988, Milestone is headquartered in Italy with its R&D and manufacturing centre in Germany and Switzerland and offices in the United States, China, Japan and Korea. We operate worldwide through a network of over 100 exclusive distributors, all providing our customers with premium application and service support. Milestone's mission is to help chemists by offering them the most advanced instrumentation for sample preparation and direct mercury analysis in the world. Our industry-leading technology, in combination with fast, responsive service and applications support, allows Milestone to support our goal of giving you the highest return on investment possible.

ADDITIONAL MILESTONE SOLUTIONS



ETHOS X 2.0

Microwave Terpenes Extraction



ETHOS XL

Microwave Terpenes Extraction for Processing

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